Endel Tulving's Monohierarchical Multimemory Systems Model

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Endel Tulving, in his paper 'How Many Memory Systems Are There' (1985), provides the answer to the question posed in the title by outlining his own monohierarchical multimemory systems model. This model supports three memory systems which work together in a quasi-dependent way, only the first system being sufficient in itself, though all higher animals will have at least the first two systems. The memory systems are procedural, semantic, and episodic.

AQUISITION:

EPISODIC: accretion, direct perception, experience

SEMANTIC: restructuring, comprehension

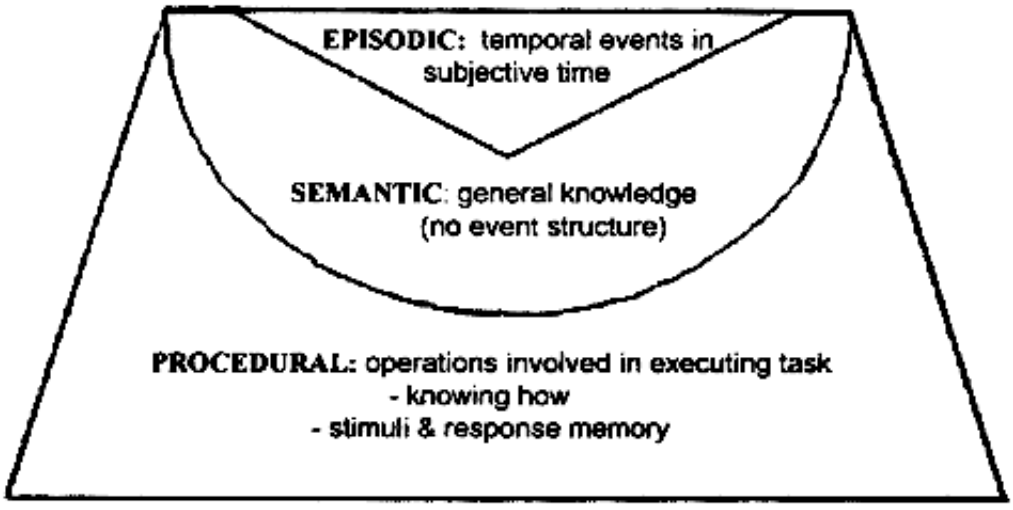
PROCEDURAL: tuning in, overt behavioral responding

REPRESENTATION:

EPISODIC: events, descriptive and relational

SEMANTIC: descriptive, facts, concepts

PROCEDURAL: prescriptive, blueprint for future action, increased probability of specific response to specific stimuli


EPISODIC: temporal events in subjective time
SEMANTIC: general knowledge (no event structure)
PROCEDURAL: operations involved in executing task
- knowing how
- stimuli & response memory

KINDS OF CONSCIOUSNESS:

EPISODIC: *autonoetic* (self-knowing), identity in subjective time, past/present/future

SEMANTIC: *noetic* (knowing), awareness of internal & external world

PROCEDURAL: *anoetic* (nonknowing), stimulus/response

EXPRESSION OF KNOWLEDGE:

EPISODIC: flexible, recollective, remembering. Access is conscious, deliberate, relatively slow

SEMANTIC: flexible, knowledge can be expressed in different circumstances than it as learned. Access is automatic & fast

PROCEDURAL: inflexible, overt

SHOUT
SHARE
IT

	response, direct expression -- determined, stimulus response learning

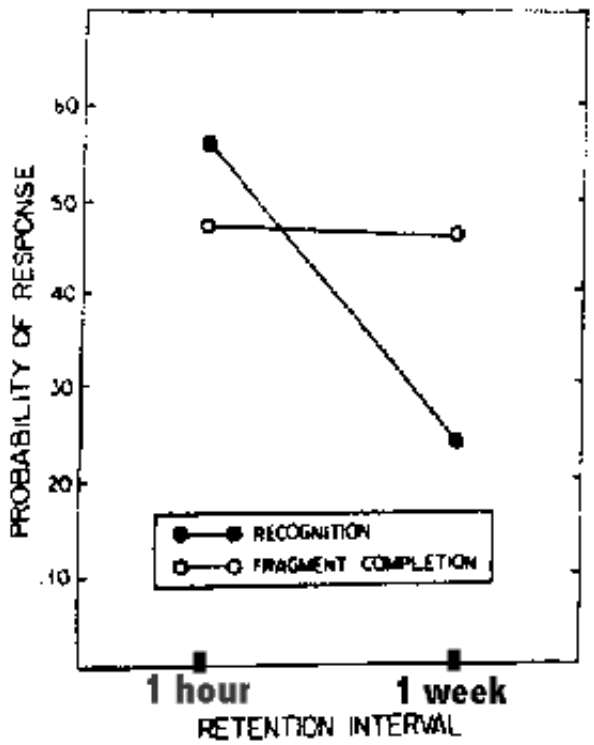
Procedural memory is most simply 'knowing how'. Wayne Podrouzek (1994, lecture) gave the example of turning a comer on a bicycle. The angle at which the bicycle must tilt in relation to the speed of the bicycle could be computed mathematically, but that's not how we do it. We just 'know how' automatically. Very simple organisms have this memory system alone (Tulving, 1985). It is a little more advanced than pure instinct since it does involve stimulus response learning, but nothing more. A hypothetical very small creature possessed only of procedural memory might avoid a particular area if it was once savagely attacked by wolves there, barely escaping with its life. It wouldn't have to 'think' about it, it would just avoid the area. In this regard it is prescriptive (Tulving, 1985), determining future behavior.

Semantic memory might more properly be termed 'generic memory' (Hintzman, 1978, cited in Main, 1994). It is memory of general knowledge which does not involve any event structure. Lower animals, very young children, and the brain damaged may possess only procedural and semantic memory (Tulving, 1985). If our very small creature was possessed of both these memory systems, coming upon the area of the unfortunate experience with the wolves it might think something like, 'Hammy, this looks like wolf-country,' and avoid the area.

Episodic memory is the memory of temporal events in subjective time ('I did this, I will do this, I remember that I have to do this tomorrow'). Tulving neglects to mention who is fortunate enough to possess all three systems, which enables him to leave unaddressed any questions of the 'do dogs and cats have souls' variety, but it would be safe to conclude that children beyond a certain undefined age and normally functioning adult humans would be the prime candidates. If our very small creature was included it could think to itself, 'The last time I went there I was savagely set upon by wolves. The world is very big and I am very small, I will only go where before I have been, where events are nurturing and kind, episodes tinted with only so much sorrow as to provide that semantic shade of blue which blends ever so ephemerally into time, effectively coloring all our days.' It could not think this unless it had all three systems, since semantic and episodic memory cannot exist alone, as "procedural memory contains semantic memory as its single specialized subsystem, and semantic memory, in turn, contains episodic memory as its single specialized subsystem." (Tulving, 1985). Thus the monohierarchical nature of the model.

Our very small creature brings up a troublesome point, though, in assigning an affective tone to a semantic concept 'blue'. For Tulving it is episodic memories which have affective tone (which one assumes is something not altogether unlike emotion or 'feeling') (Tulving, 1983, cited in McKoon, Ratcliff, and Dell, 1986). McKoon et al. essentially concede the point but they "attribute the difference to the content of the memories, not to separate stores." (McKoon et al." 1986)

A piece of evidence for separate memory systems comes from the experiment in Tulving, Schacter, & Stark (1982). Given limited space I will refer the reader to the following diagram. The important thing to note about this experiment, the point upon which Tulving's theory of separate memory systems depends, is the dissociation between the recognition task and the word fragment completion task.



Graph from *Priming Effects in Word-Fragment Completion Are Independent of Recognition Memory* (Tulving, Schacter, & Stark, 1982, *Journal of Experimental Psychology: Learning, Memory, and Cognition 8:4:336-342, © 1982, American Psychological Association.)*

EXPERIMENT IN BRIEF

- Present subjects with a list of words.
- An hour later, test for:
  - recognition
    - Was this word in the list? Answer yes/no.
  - word fragment completion
    - _G_O_T_C
  - Repeat test a week later.

Over the week recognition declined while word fragment completion ability remained virtually the same.

Dissociation: Two different things, independent, therefore two different memory systems.

- Recognition - have you seen this before? -- episodic
- Word fragment completion -- physical properties of word -- possibly semantic, possibly procedural, possibly something else.

"We could refer to this unknown system as the QM system (QM for question mark) and keep our eyes and minds open for evidence for and against its hypothesized existence." - Tulving, 1985

Tulving interprets the time-dependent recognition task as being the concern of episodic memory, while he remains uncommitted to the nature of the memory system involved in the word fragment completion task. One of his coworkers on this 1982 paper, Schacter, later went on to assign phenomenon like word fragment

completion to the visual word form system within a system of perceptual representation systems, essentially subsystems which could be accessed by any memory system, multi- or unitary (Schacter, 1990).

Tulving (1985) describes three modalities of these memory systems; *acquisition, representation, expression of knowledge,* and goes on to describe the *kind of*

consciousness of each. In procedural memory acquisition is by overt behavioral responding. Something happens which elicits a response, if the response is successful it is likely to be repeated. Where, exactly, the response initially comes from Tulving doesn't make clear, at least not in this paper (1985). Hopefully it isn't purely instinctual, or else the need for this kind of learning is unnecessary, except, perhaps, to reinforce instinct, if it needs reinforcing... A troublesome question best ignored in a short paper. Certainly those of us with all three systems can learn to ride a bicycle through 'overt behavioral responding' (doing it and trying not to fall over), but we at least have some idea of what (semantic) it is we are trying to accomplish (episodic - specific accomplishment of objective, intentional eventual acquirement).

In semantic memory we acquire knowledge through comprehension (Main, 1994). If you don't get it you haven't got it. Acquisition in episodic memory is by I accretion, direct perception, experience (Tulving, 1985). Basically knowledge adds up over time.

Representation in procedural memory, as mentioned already, is prescriptive - it is a "blue print for future action," (Tulving, 1985), and is manifested in an increased probability of a specific response to a specific stimuli. Semantic memory is *descriptive* of concepts and facts. Likewise representation in episodic memory is also descriptive, but of events, and it is relational in terms of how these events go together (event structure, plot, story-line).

In procedural memory expression of knowledge is an inflexible direct expression acquired through stimulus/response learning, according to Tulving, yet what would our very small creature possessed only of procedural knowledge do if, after having fallen off of a cliff and injured itself badly, a very kind wolf carried it back to its den and nursed it back to health and released it without even taking a nibble out of it? Can it be that inflexible? Would not a little flexibility be something of an adaptive advantage? Not if upon beaming at the next wolf to come along the very small creature were devoured. Again, a question best ignored in a short paper.

Expression of knowledge in semantic memory is more flexible in that it can be applied to situations other than the one in which it was initially learned. Yet could not the same be true of procedural memory? What of Baby Albert's fear of all things furry, a generalized classically conditioned response originally connected to rats (Watson and Rayner, 1920, in Krebs and Blackman, 1988)? Also problematic is Tulving's assertion that in semantic memory access is automatic and fast. McKoon et al. (1986) ask for a fruit beginning with the letter 'k'. Most people will pause at least briefly before answering 'kiwi'.

Expression of knowledge in episodic memory is also flexible, but differs from expression in semantic memory in that access is conscious, deliberate, and takes time to recall (Tulving, 1985). Again, it is not difficult to find exceptions. There are memories of events we were involved in which, for better or worse, are always close to hand. And sometimes we unintentionally remember things in response to certain cues, not always definable.

Finally, there are the 'kinds of consciousness'. *Anoetic* consciousness is the term Tulving applies to the kind of consciousness of procedural memory (1985). It means unknowing knowing' or 'unconscious consciousness', something of a contradiction in terms, yet not surprising in the context of memory theory, given that procedural memory seems so clearly 'other' than other proposed types of memory. If it is as real as it seems to be, then it may indeed be inflexible, inflexible to conforming to any given theoretical scheme, since it doesn't seem to bend. It's almost Taoist - 'doing does', 'knowing without knowing', etc.

Simply *noetic* is the consciousness of semantic memory. It is an awareness of the internal and external worlds (Tulving, 1985). We know what our address is and likely what is the nearest major intersection. We can identify our emotions. We can consider the feeling of joy (despite its affectional tone) without necessarily associating it with an event, at least not consciously.

Autonoetic describes the consciousness of episodic memory. It is identity in subjective time (Tulving, 1985). It is 'I', it is the psyche in psychology, the big consciousness of consciousness. *Je pense donc je suis* (Descartes, 1637, in Trager, 1992). Obviously 'psyche' is more complicated than 'anoetic consciousness' (which may be why the angelic fear to tread there), but congratulations to Tulving for even his obftuscajargontory implication of something of the kind.

Without going into great detail, McKoon et al's (1986) criticism of Tulving's model are primarily in regard to two main areas: *definition* - where the distinction between semantic and episodic memory is not well enough defined to be testable, and consequently results of experiments that claim to prove such a distinction must be viewed as inconclusive; and *modeling* - where the *processes* need to be modeled, not just labeled, since merely labeling them "does not provide a theoretical explanation, but only a categorization." (McKoon et al., 1986)

Part of the problem derives from the nature of Tulving's 'model'. As pointed out by Main (1994), it "focuses on the *nature* of the material that is stored in memory." As such it is qualitatively descriptive right to its foundation which may make it somewhat elusive to empirical quantitative verification.

McKoon et al. also provide outlines of several experiments which seem to contradict Tulving's theory, and note Roediger's (1984, cited in McKoon et al., 1986) concern that dissociations may exist between different processes within a system and therefore cannot be used as the only evidence for separate memory systems. This is a point which is taken up by Schacter (1990) when he wishes to make clear that the existence of separate processing modules of his perceptual representations system approach "need not be taken *as primafacie* evidence for the existence of multiple memory systems," and goes on to note that dissociations alone are "not sufficient grounds for postulating multiple memory systems, because empirical dissociations *within* a system can be observed (e.g., Roediger, 1984)." Also important is consideration of functions of systems, since to argue for multiple memory systems the systems in question should perform *"different* and *mutually incompatible* functions." (Sherry and Schacter, 1987, cited in Schacter, 1990, italics mine). Given the complementary nature of semantic and episodic memory in Tulving's model (1985), and the dependence of episodic memory upon semantic memory, it would not seem to satisfy that last requirement. Likewise McKoon et al. (I1986) question 'just how different ultimately, the monohierarchical multimemory model is from a unitary system given the degree of interrelatedness of the components**.** Is it not perhaps a unitary system with three processes?

By the tenor of the times, Tulving's time is up. He is a pantheist in a time of monotheism. He seeks multiplicity while others want to believe in something unitary. He has the gift of imagination. In answer to the question posed in the title of his 1985 paper Tulving says that there are basically three systems, "But if we try to imagine what might lie beyond our currently limited horizon we may decide that a better answer might be "at least three and probably many more."" (Tulving, 1985)

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